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Management effects on greenhouse gas emissions from a fen covered with riverine silt

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Drainage is necessary to use peatlands for conventional agriculture, but this practice causes high emissions of the greenhouse gases carbon dioxide (CO_2) and nitrous oxide (N_2O). The effect of hydrological conditions and management on greenhouse gas (GHG) emissions from "true" peat soils is relatively well examined, but there is little data on GHG emissions from organic soils covered with mineral soil. Such a cover may either be man-made to improve the trafficability of the fields or natural, e.g. due to the deposition of riverine silt. Such mineral covers are widespread in North-Western Germany and other regions with intensively used peatlands. Here, we aim to evaluate the effect of management, water table depth and properties of the mineral cover on the emissions of CO_2, N_2O and methane (CH_4).

As the majority of peatlands in North-Western Germany, the study area is used as grassland. The area is artificially drained and intensively used (4 to 5 cuts per year, annual nitrogen fertilisation of 112 to 157 kg/ha). The fen peat with a thickness of 0.6 to 1.50 m is covered by riverine silt deposited by the river Weser. Six measurement sites have been chosen to represent typical agricultural management, soil properties and hydrological conditions of one hydrological management unit. The sites differ in the soil organic carbon (SOC) content of the riverine silt (4 – 15 % SOC), the occurrence of a ploughed horizon as well as water and agricultural management. We use static closed chambers to measure CO_2, CH_4 and N_2O fluxes. CO_2 measurement campaigns using transparent and opaque chambers and a portable IRGA take place every third or fourth week depending on season. CH_4 and N_2O samples are taken every second week and, in addition, on the first, third and seventh day after fertilizer application. Samples are analyzed by gas chromatography.

First results show negligible CH_4 fluxes due to low groundwater levels. Total N_2O emissions reflected mainly the different fertilizer application rates although there were rarely specific N_2O peaks directly after fertilizer application, probably due to low soil moisture during these periods. Estimated from the first six months of data, N_2O emissions from peat soils covered with riverine silt are in the same range as emissions from true peat soils with comparable fertilisation rates. First results on CO_2 emissions will be presented as well.